EXAMINING TOPOGRAPHY OF MARS IMPACT BASINS TO DETERMINE IF IMPACT BASINS HAVE TOPOGRAPHIC CHARACTERISTICS OF A CRATER. A. Livingston[1], K. Lewis[1], J. Simmons[1], D. Chavez[1], K. Gchachu[1], [1]Southwestern Indian Polytechnic Institute, H.E. Newsom[2], V. Sutherland[2], H. Gordon[2], [2]University of New Mexico, T.M. Hare[3], [3]U.S. Geological Survey, Flagstaff, AZ.

Introduction: Determining the topography of suspect craters on Mars will help scientists better understand the land deformation that occurs from an asteroid or comet impact. This will provide a better understanding of how Mars has changed over time and the topography data could be used for planning future missions to Mars. We have begun a program at the Southwestern Indian Polytechnic Institute (SIPI), a Bureau of Indian Affairs junior college, to analyze large impact basins on Mars (>300 km diameter) utilizing Geographic Information System (GIS) technology. Collaborators at the University of New Mexico and the U.S. Geological Survey are providing technical support for this effort.

Fig. 1 Photo of Barringer Meteor Crater in Arizona with pronounced crater topography characteristic of a simple crater.

Procedure: Determining whether a suspect crater on Mars has the topographic characteristics to be considered an impact structure involves the analysis of elevation data collected by the Mars Orbital Laser Altimeter (MOLA). The MOLA elevation data has been transferred to a GIS computer program, which provides the data handling system.

The data is then analyzed in the GIS program with a topographic analysis tool (Fig. 2) crated by Trent Hare (USGS), Van Sutherland (UNM) and Heather Gordon (UNM).

The profile tool takes elevation data from each degree radian of the crater out to a specified distance. The profiles are then exported to an Excel spreadsheet for plotting and analysis (Fig. 3). To simplify analysis the data are then averaged into ten-degree radial bins, for a total of 36 profiles.

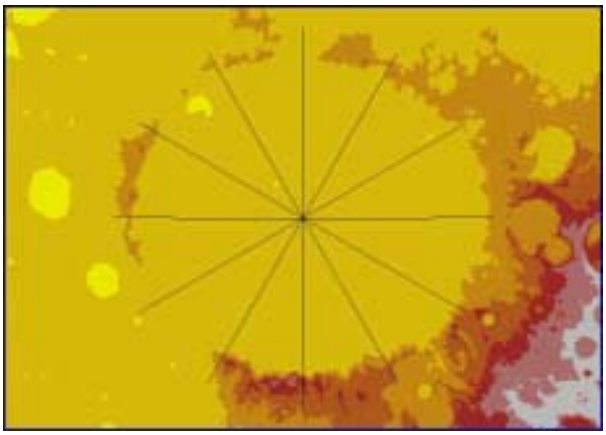

Fig. 2 A plan view of Schiaparelli Impact Basin, which is an example of a complex crater. The figure shows examples of the radial paths created using the topographic analysis tool that are used to create profiles as seen in Fig. 3.

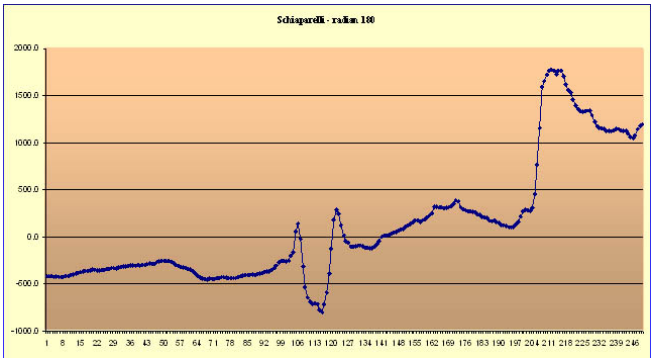

Fig. 3 Schiaparelli Impact Basin elevation data transported to Excel and plotted on a line graph.

Once all of the 36 graphed profiles have been scaled, the same the profiles can be transferred to poster board and arranged into a circle and a physical three-dimensional model can be produced (Fig. 4). The advantage of having a physical model is that the analyst can have a three-dimensional visualization of the crater, which makes for an easier examination of the topography. We will also be using the GIS

technology to create digital three-dimensional models of the impact basins for analysis.

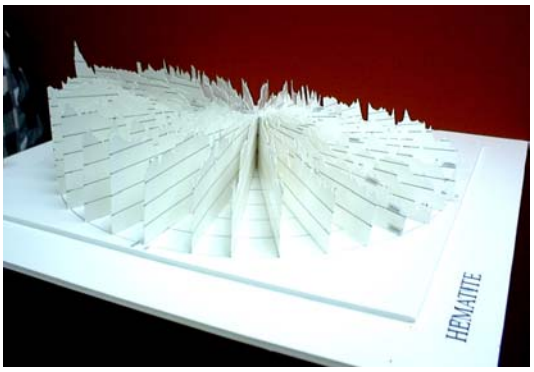

Fig. 4 Three-dimensional model of the Meridiani Planum hematite-rich region on Mars.

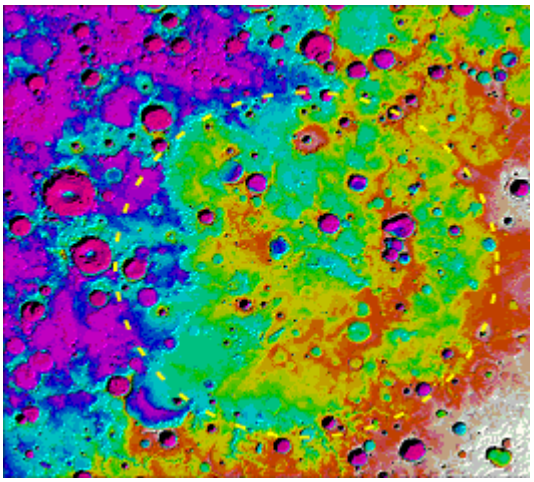

Fig. 5 Mars Orbital Laser Altimeter (MOLA) image of the Meridiani Planum hematite-rich region showing the outer wall of the annular trough of the large 800 km diameter basin identified by Newsom et al. [3].

Analysis: An example of the kinds of analysis that can be done using the radial profiles involves the analysis of an 800 km diameter structure identified in Meridiani Planum [1]. This region contains one of the two large deposits of the iron-oxide mineral hematite. The result form the Meridiani Planum area analysis shows that only about 47.2% of the 36 profiles of the outer rim of the annular trough of the structure exhibit the topographic characteristics of a crater (Fig. 5). Although, the topographic data does not show a full 360 degree crater profile, the process of erosion on the western side may have contributed to the removal of the topographic signature of the outer wall.

Training: The development of the impact basin project at SIPI provides the SIPI students with knowledge of the basic computer skills, such as Microsoft Excel and training with advanced GIS techniques, such as ESRI's ARCINFO program. The students also benefit from learning about planetary science and career opportunities with NASA and related institutions. Writing abstracts and presenting results at meetings such as the Lunar and Planetary Science Conference allows the students to obtain presentation skills.

Conclusion: With the use of MOLA, GIS programs, and Excel, topographic information can be better analyzed and understood. These tools also help produce topographic data that is more precise and helps research to be produced faster.

References: [1] Newsom, H.E., et al. (2002), *LPS XXXIII,* #1855. [2] Karner, J. M., Jones, R.H.

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